

Solved at last: The Philippine endemic *Psychotria philippensis* is a synonym of *Scyphiphora hydrophylacea* (Rubiaceae, Scyphiphoreae)

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Abstract

Psychotria philippensis (Rubiaceae) was described by Chamisso and Schlechtendal in 1829, was the first *Psychotria* name published for the Philippines and is currently considered a Philippine endemic. The name remained in a taxonomic limbo for almost two centuries as it was variously accepted, synonymized or considered obscure, probably because the type specimen in the Berlin herbarium was destroyed and no original material has survived or is currently known. A combined analysis of the information on morphology, type locality and ecology contained in the protologue and a review of relevant literature on the study of the name by various authors over the last two centuries finally clarified the identity of *P. philippensis*. The name is confirmed here as a synonym of the rubiaceous mangrove *Scyphiphora hydrophylacea*, as first proposed by Schumann, one of the authorities of the family in the late 19th century, and the application of *P. philippensis* is fixed by neotypification. This reduces the number of Philippine species of *Psychotria* by one, but fortunately, this is not happening through extinction, as has been the case with too many species of the highly endangered Philippine flora. In addition, the history of the discovery and study of *S. hydrophylacea* and its synonyms are described in detail, and one lectotype and one neotype are designated.

Keywords

Chamisso, herbarium history, Paleotropical Rubiaceae, The Philippines

Introduction

The Philippines is one of the world's top 25 biodiversity hotspots and one of the eight “hottest hotspots” in terms of endemic species and habitat loss (Myers et al. 2000; Brooks et al. 2006; Posa et al. 2008; Webb et al. 2010). One of the largest groups in the Philippine flora and the tropics is the coffee family (Rubiaceae), with more than 13,000 described species. Rubiaceae is represented in the Philippines by more than 455 native species in 74 genera and 25 tribes (Alejandro 2007). Merrill (1923–1925, 1923a, b, 1926) published the first complete account and enumeration of Philippine flowering plants and formed the basis for subsequent research on the Philippine Rubiaceae. Later, Alejandro and Liede (2003) and Alejandro (2007) updated Merrill's list with species described since then and changes in generic concepts, but noted that some groups are still poorly known due to the size and taxonomic complexity of the family and the need for modern revision. Fortunately, several recent monographic studies have greatly improved our knowledge of the family in the region (e.g., Alejandro et al. 2010, 2011, 2016; Wong and Low 2011; Obico and Alejandro 2012; Pereira and Ridsdale 2012; Chavez et al. 2020).

Among the genera revised recently in the Philippines, is *Psychotria* (Psychotrieae), the largest and most complex genus of Rubiaceae in the Philippines and elsewhere. Sohmer and Davis (2007) recognized 112 *Psychotria* species and 17 infraspecific taxa, of which 106 are endemic and 25 are only known from the type. The broad circumscription of *Psychotria* was subsequently narrowed following morphological and phylogenetic studies, which led to the exclusion of numerous segregates in the tribe Palicoureeae (Nepokroeff et al. 1999; Robbrecht and Manen 2006; Razafimandimbison et al. 2014). On the other hand, long-recognized segregates such as the myrmecophytic Hydnophytinae C.R.Huxley & Jebb (or the genera *Cremocarpon* Boivin & Baill. and *Pyragra* Bremek. not present in the Philippines) were found to be nested in *Psychotria*. In the current delimitation of *Psychotria*, its center of diversity lies in the Palaeotropics, and it includes at least 1,600 species of trees, treelets, shrubs, subshrubs, herbs, climbers and epiphytes (Razafimandimbison et al. 2014). Following these authors, the two species comprising the Membranifolia Species Group in Sohmer and Davis (2007) were excluded from *Psychotria* and transferred to an expanded *Eumachia* within Palicoureeae (Taylor et al. 2017).

With few exceptions, all of the 110 remaining *Psychotria* species are probably endemic to the Philippines, but a full assessment would require a better knowledge of the Southeast Asian and especially the Bornean species. They are predominantly found in primary forests and have narrow distributions making them prone to extinction. Following a drastic decline in primary forest cover over the last century, many species have not been seen for decades, leading Koopowitz et al. (1998) and Sohmer (2001) to assume that more than half of the Philippine species of *Psychotria* are extinct. In contrast, Sohmer and Davis (2007) provided a more optimistic estimate of extinction rates of up to 28%, but a few of these presumably extinct species have since been rediscovered by local botanists (Ordas et al. 2019; Biag and Alejandro 2020, 2022; Batuyong et al.

2021). Apparently, several primary forest species can tolerate some disturbance and escape extinction in relatively more widespread secondary forests (Sohmer and Davis 2007; Biag and Alejandro 2022).

Taxonomic history of *Psychotria philippensis* Cham. & Schltdl.

Five *Psychotria* names could not be assigned in the revision of Sohmer and Davis (2007). These include the first *Psychotria* name published for the Philippines and named after the archipelago: *Psychotria philippensis* Cham. & Schltdl. (Chamisso and Schlechtendal 1829a). Sohmer and Davis (2007: 238) excluded the name from *Psychotria* but could not assign it to a genus due to the missing type material.

A year after its publication in 1829, *Psychotria philippensis* was already in use and was included in the *Prodromus* of de Candolle (1830: 505–506) in an attempt to summarize all known seed plants. However, Candolle did not examine any specimens, and his description is essentially an abbreviated version of that published in the original protologue, a limitation that many subsequent authors had in understanding the identity of the name. Miquel (1857: 282) was the first to conclude that *P. philippensis* was misplaced in *Psychotria* but incorrectly suggested an affinity with *Chassalia*, a palaeotropical genus of the tribe Palicoureeae. Naves and Fernández-Villar (1880: 112, “Verè distinctissima species”) again accepted *P. philippensis* as a species of *Psychotria*, referring to a specimen they identified as this species and had seen in the herbarium of Sebastián Vidal (now at MA, the herbarium of the Real Jardín Botánico, Madrid, Spain). However, the identity of the material they examined seems doubtful since they gave the Caraballo Mountains in central Luzon as the locality, where the presence of the species (a mangrove species, see below) is ecologically impossible. Kuntze (1891) considered *Uragoga* Baill. the correct name for *Psychotria* and proposed the combination *U. philippensis* to accommodate the species. In his enumeration of Philippine Rubiaceae, Elmer (1906: 32) retained *P. philippensis* as an accepted species. Furthermore, he recognized that the elongated, spindle-shaped or fusiform drupes of *P. philippensis* are unusual and differentiate the species from all congeners.

Karl Moritz Schumann (1851–1904), professor of botany and curator at the Berlin herbarium (B), contributed the family Rubiaceae to Engler’s “Die Natürlichen Pflanzenfamilien”. He was the first to place *Psychotria philippensis* in the synonymy of the rubiaceous mangrove tree, *Scyphiphora hydrophyllacea* (Schumann 1897: 80). He did not give details of his reasoning, but likely he may have seen the type specimen in B, where he worked. Years later, Merrill examined the type at B again (Merrill 1915: 129). He did not reference Schumann’s earlier work but reached the same conclusion and synonymized *P. philippensis* under *S. hydrophyllacea* in his “Studies on Philippine Rubiaceae” (Merrill 1915: 129) and in his “Enumeration of Philippine Flowering Plants” (Merrill 1923b: 533).

Most of the Berlin herbarium was destroyed during World War II (Hiepko 1987), the type of *Psychotria philippensis* was lost and the identity of the name remained un-

studied for several decades. Sohmer and Davis (2007: 238) again excluded the name from *Psychotria* and concluded an affiliation with Rubiaceae but could not assign the name to any genus. The species was not included in the list of Philippine Rubiaceae by Alejandro (2007) but was again listed as an accepted species of *Psychotria* in the checklist of Philippine vascular plants by Pelser et al. (2011 onwards), and subsequently in the World Checklist of Rubiaceae (Govaerts et al. 2022, published online and accessed Oct. 2022, but recently discontinued) and the Plants of the World Online (<http://powo.science.kew.org>, accessed Feb. 2023), who probably overlooked the synonymizations by Schumann and Merrill or reached a different conclusion on the identity of the name. Wong et al. (2019) gave the most recent treatment and synonymy of *Scyphiphora*, but *P. philippensis* was not listed as a synonym.

The identity of *Psychotria philippensis* as a synonym of *Scyphiphora hydrophylacea* is finally established here by a combined analysis of morphological and ecological information in the protologue and an analysis of the historical studies of the name by various authors. Furthermore, the application of the name is fixed by neotypification. This reduces the number of Philippine species of *Psychotria* by one, but fortunately, this is not happening through extinction, as has been the case with too many species of the highly endangered Philippine flora.

Psychotria philippensis and *Scyphiphora hydrophylacea*

Chamisso and Schlechtendal (1829a) described *Psychotria philippensis* as a resinous shrub of mangroves (“in maritimis”) with paired axillary or supraxillary inflorescences and subcylindric drupes with acute ridges. Resin production, inflorescence structure and habitat immediately exclude the name from *Psychotria*, which has terminal or solitary-pseudaxillary inflorescences and does not occur in mangroves or other coastal habitats (e.g., Sohmer and Davis 2007; see also Taylor 1996, 2020 and Lachenaud 2019). Instead, the detailed and elaborate description in the protologue is an excellent and unambiguous match for *Scyphiphora hydrophylacea*, a rare and endangered mangrove species that is distributed from East India and Madagascar to the Western Pacific and Northern Australia, including the Philippines (e.g., Puff and Rohrhofer 1993; Alejandro and Liede 2003; Alejandro 2007; Almazol and Cervancia 2013). Thus, there is no reason to doubt the identifications of Schumann (1897: 80) and Merrill (1915, 1923b), who did extensive work on Philippine and other Rubiaceae and were probably the only botanists to examine any of the type specimens.

The monotypic *Scyphiphora* is unusual within Rubiaceae in a number of ecological and morphological characters and is surveyed in detail by Puff and Rohrhofer (1993): It is the only member of the family that occurs in mangrove vegetation. Thus, it is exposed to the influence of salt or brackish water, which only a few Rubiaceae, such as the coastal *Guettarda speciosa* L. (Guettardeae) and *Hydrophylax maritima* L. f., can withstand (e.g., Puff et al. 2021). *Scyphiphora* is typically associated with species of the Rhizophoraceae and other mangroves but is never a dominant component. Its phylogenetic position was long unclear until molecular phylogenetic data showed that it belongs to the Vanguerieae alliance within the subfamily Ixoroideae and is best

placed in the monotypic tribe Scyphiphoreae Kainul. & B. Bremer (Mouly et al. 2009; Razafimandimbison et al. 2011; Kainulainen et al. 2013). Finally, recent phylogenetic studies have demonstrated that Scyphiphoreae is sister to the monotypic Southwest Chinese Trailliaedoxeae Kainul. & B. Bremer, and together are sister to the *Glionnetia*–*Vanguerieae*–*Greeneae*–*Ixoreae* clade (Wikström et al. 2020).

The fruits of *Scyphiphora* are somewhat reminiscent of those of *Psychotria*. Both genera have bilocular drupaceous fruits, but *Psychotria* has fleshy, usually red, bird-dispersed drupes, usually with two one-seeded pyrenes embedded in the fruit pulp. When fresh, these fruits are more or less globose to ovoid or obovoid, and the longitudinally ribbed pyrene surface becomes apparent only in dried fruits (e.g., Taylor 1996, 2020; Sohmer and Davis 2007; Lachenaud 2019). The only exceptions from that fruit type are species of the former genus *Cremocarpon* and *Pyragra* with dry schizocarps nested within a broadly defined *Psychotria* (e.g., Razafimandimbison et al. 2014; Taylor 2020).

Meanwhile, the fruits of *Scyphiphora* are drift fruits adapted for sea dispersal, a rare dispersal mechanism in the family, otherwise found in few other members of the family that occur in coastal vegetation, for example, in *Guettarda speciosa*. The fruits of *Scyphiphora* are two-locular with two superposed ovules per locule, one ascending, the other descending. When the fruits are mature, they are elongated, dry, brownish and strongly longitudinally ridged. Most of the pericarp and the prominent ribs are composed of mesocarp, which consists of dead, thin-walled, lignified cells. Their lumina are connected by numerous pits and are probably air-filled to increase their buoyancy. The skin-like exocarp is thin, parenchymatic, dry and usually detaches to some extent when the fruits mature. Finally, the endocarp is thin, dry, and heavily sclerified, enclosing each of the two locules. In mature fruits, the seeds are connate by layers of parenchymatic cells, the fruits therefore do not separate into mericarps and the seeds are dispersed together. As pointed out by Puff and Rohrhofer (1993), the fruits were often referred to as “fleshy” or “drupes”, but the entire pericarp is dry when mature and these terms therefore are inaccurate.

Chamisso and his collections

Between August 1815 and August 1818, the Chancellor of the Russian Empire, Count Nikolai Romanzoff (1754–1826), commissioned an expedition around the world on the Russian brig Rurik under the command of Captain Otto von Kotzebue (1787–1846). In addition to their primary goal of finding the Northeast Passage from the Bering Strait to the Atlantic Ocean, they aimed to make scientific collections, for which they hired the famous poet and belated botanist Ludolf Karl Adelbert von Chamisso (1781–1838; see Schlechtendal 1839 and Schmid 1942 for biography and bibliography), zoologist Johann Friedrich von Eschscholtz (1793–1831) and artist Louis Choris (1795–1828). The extensive diaries and travelogues of Chamisso (1836a, 1836b), Kotzebue (1821) and Choris (1822) give rather detailed contemporary views of the Romanzoffian expedition, and Bzdziach (2004) and Maass (2016) provided excellent historical contextualization.

In his first report to Romanzoff, Chamisso (1818: 206) estimated that they had collected about 2,500 plant species, one-third of which were undescribed. Upon returning

from the expedition, Chamisso received permission to take his entire collection to Berlin to study and publish the taxonomic novelties, where they remained until his death (Hiepko 2004; Maaß 2016: 134; see also Chamisso 1818: 208). To this day, the total size of the collections remains unknown. Still, it is clear that the same species were often collected in several places, and each gathering consisted of numerous duplicates, which partly explains the wide dissemination of many Chamisso specimens (e.g., Maaß 2016: 171–172).

Chamisso donated a complete set of specimens from the expedition on the Rurik to the Berlin Herbarium (B). As stipulated in his will, an additional set of “1,800 plant species” was given to his successor at B, Johann Friedrich Klotzsch, who also donated them to the herbarium (Schlechtendal 1839: 104; Urban 1917: 19, 22, 336). Unfortunately, most of B was destroyed during World War II, including most of the two sets of Chamisso’s collections deposited there (Hiepko 1987). Duplicates are expected in HAL (see below), where the herbarium of his close friend Schlechtendal, professor of botany and director of the Botanical Garden of the University of Halle, is kept (Werner 1988; Braun and Wittig 2003). Schlechtendal received part of Chamisso’s collections during their joint work in Berlin on the publication of the plants from the expedition on the Rurik (e.g., Chamisso 1826, 1830; Chamisso and Schlechtendal 1826a, b, 1827, 1829a, b).

In 1840, two years after his death, Chamisso’s private herbarium, which contained up to 12,000 species and 60,000 specimens of his and many of his contemporary collectors (Ruprecht 1864: 4), was acquired by the St. Petersburg Academy of Sciences and is now in the herbarium of the Komarov Botanical Institute (LE). This collection is said to include most of the specimens from the Romanzoffian expedition, but the specimens are generally unmounted and difficult to access and study (Imchanitzkaja 2004).

Taxonomic treatment

***Scyphiphora hydropylacea* C.F.Gaertn., Suppl. Carp. 1(2): 91–92, tab. 196, fig. 2. 1806.**

- = *Epithinia malayana* Jack, Malayan Misc. 1(5): 12–13. 1820. ≡ *Scyphiphora malayana* (Jack) Bedd., Fl. Sylv. S. India Forester’s Man. Bot.: cxxxiv–3, tab. 29., fig. 5. 1874, nom. inval. Type: Singapore. Singapore Island [protologue: “Found in Mangrove swamps on the Island of Singapore.”], s.d., W. Jack s.n. (lectotype, designated by Wong et al. 2019: 283: L [L 0001344]).
- = *Psychotria philippensis* Cham. & Schltdl., Linnaea 4(1): 21–22. 1829a. ≡ *Uragoga philippensis* (Cham. & Schltdl.) Kuntze, Revis. Gen. Pl. 2: 962. 1891. Type: Philippines. Luzon, Calabarzon Region, Cavite Province: Noveleta [protologue: “Legimus in maritimis circa Tierra-alta Luçoniae.”], 1817–1818, L. K. A. von Chamisso s.n. (type, B†). Neotype: Philippines, Palawan Province: Culion Island, August 1913, L. Escritor s.n. in Merrill: Species Blancoanae 635 (neotype, here designated: US [00624079]; isoneotypes: L [L.2962064], P [P03972577], W [W 0131765]).

- = *Ixora manila* Blanco, Fl. Filip.: 60–61. 1837. Type: Philippines. Palawan Province: Culion Island, August 1913, L. Escritor s.n. in Merrill: *Species Blancoanae* 635 (first-step neotype, designated by Merrill 1918: 364; second-step neotype, here designated: US [00624079]; isoneotypes: L [L.2962064], P [P03972577], W [W 0131765]).
- = *Hydnophytum costatum* Drake, J. Bot. (Morot) 9: 240–241. 1895. Type: Vietnam. Quảng Ninh Province: Surroundings of Quảng Yên [protologue: “Environs de Quang-Yen, au milieu des palétuviers (685).”], August 1885, B. Balansa 685 (lectotype, designated by Wong et al. 2019: 283: P [P00836559]).

Type. Indonesia. Java, Jawa Barat: Anyer [protologue: “*Hydropylax*. Collect. Banks.”], 2. Oct. 1770, *unknown collector* in *J. Banks* s.n. (lectotype, here designated: BM [BM000945301]).

The type of *Psychotria philippensis*

Psychotria philippensis was published in a series on the botanical results of the Romanzoffian expedition on the Rurik prepared by Chamisso and Schlechtendal (1829a). The protologue gives “in maritimis circa Tierra-alta Luçoniae” as a rather minimalistic collection locality. Fortunately, more detailed information can be derived from the diaries and travelogues of Chamisso (1836a, b) and Kotzebue (1821). According to them, the Rurik stayed in the port of Cavite from 18 December 1817 to 28 January 1818 for refurbishments, the most important Philippine fortress and an arsenal of the Spaniards at that time. Knowing that Cavite had little to offer a botanist, Chamisso quickly settled in Tierra Alta, then a small village on the high shore of Manila Bay, where the sandy headland of Cavite joins the adjacent mainland.

Chamisso noted that the lush forests around Tierra Alta extend from the mountains to the coast, where “*Rhizophora* and other trees reach into the sea” (Chamisso 1836b: 118). He spent most of his time in the Philippines here and roamed the area around Tierra Alta, where he also collected the type specimen of *Psychotria philippensis* (Chamisso and Schlechtendal 1829a). Chamisso first passed through Tierra Alta on 27 December 1817, when he travelled overland from Manila back to Cavite. The French nobleman Don San Jago de Echaparre offered him hospitality there, and he returned to work in Tierra Alta a few days later. He stayed there until 12 January 1818, when he first left for an eight-day expedition to Taal Lake and Volcano in the interior, returning to Cavite shortly thereafter.

The type collection of *Psychotria philippensis* (apparently mentioned by him as one of the “other trees” in the remark quoted above) can thus be dated and localized to the mangroves around Tierra Alta and a period of about two weeks. According to information on the neotype, US 00624079, *Scyphiphora hydrophylacea* was already extinct in the entire Manila Bay region by around 1913, where it was once widespread (Blanco 1837: 60–61, as *Ixora manila*). This is even more tragic as Blanco reported that the native Tagalog names he attributed to the species, *nilad* and *manilad* or *may-nilad*, places where *nilad* is abundant, ultimately led to the name Manila. This notion is, however, rejected by modern authors (e.g., Baumgartner 1975).

After the destruction of B, where Schumann and Merrill had seen the only known type specimen, there should have been additional original material of *Psychotria philippensis* found in HAL and LE, which hold the largest extant parts of Chamisso's herbarium (see above). However, no specimens are currently known in either of these herbaria (HAL: Braun and Wittig 2003; LE: Larisa Orlova, personal comment) or other collections (JSTOR Global Plants database, <http://plants.jstor.org>; accessed February 2023). Searches in the herbarium of the Natural History Museum, Vienna (W), where three Chamisso specimens of *Psychotria* recently resurfaced in the extensive private herbarium of Stephan Ladislaus Endlicher (1804–1849), professor of botany and director of the Botanical Garden and Botanical Museum of Vienna, were also unsuccessful (Berger 2018; see also Bräuchler et al. 2021).

Therefore, the name *Psychotria philippensis* is neotypified here, fixing the application of the name after nearly two centuries of uncertainty (ICN, Art. 9.8, 9.13; Turland et al. 2018). The specimen designated as neotype was collected by Leonicia Escritor on Culion Island, Palawan, and is no. 635 of the exsiccatae series "Species Blancoanae" issued by Merrill. In this series, he distributed selected specimens that he considered particularly characteristic of the species published by Francisco Manuel Blanco (1778–1845) in the first two editions of his "Flora de Filipinas" (Blanco 1837, 1845) and the third edition edited by Andrés Náves (Blanco 1877). Blanco did not preserve specimens, and the interpretation of some of his names remained problematic until Merrill (1918) published his critical revision "Species Blancoanae" after a thorough study of the publication. In 1916, he issued a corresponding set of "illustrative specimens" for each of Blanco's names as he understood them.

For example, Merrill (1918: 364) identified *Ixora manila* (Blanco 1837) as the previously published *Scyphiphora hydrophylacea* and distributed the specimens mentioned above to clarify the application of the name *Ixora manila* (see also Naves and Fernández-Villar 1880: 109, tab. 277). Thus, he anticipated the concept of the neotype, and his "illustrative specimens" can be understood today as first-step neotypifications of the respective names. In a subsequent second-step neotypification the designation may be narrowed to a single specimen (ICN, Art. 9.17, Turland et al. 2018; see also Nicolson and Arculus 2001). Indeed, many of Blanco's names were later neotyped with specimens from Merrill's "Species Blancoanae" (e.g., Nicolson and Arculus 2001).

According to a letter preserved at the United States National Herbarium (US), Merrill prepared 15 sets of his "Species Blancoanae", each with 1046 specimens, and sent the first to US. Furthermore, he stated that the set at US was the only set that included original data such as field labels or notes and typewritten drafts of the treatments in the "Species Blancoanae". According to Nicolson and Arculus (2001), specimens from these sets are now represented in many herbaria including A, B, BM, BO, CAL, F, GH, K, L, MO, NSW, NY, P, U, UC, US and W. These usually have minimal labels stenciled "Merrill: Species Blancoanae No." in black ink followed by a number stamped in blue ink (Nicolson and Arculus 2001).

Although the above-mentioned gathering "Species Blancoanae" 635 is not from the Manila Bay, it serves as an excellent neotype for *Psychotria philippensis* because

the gathering has duplicates in many herbaria and agrees with both Merrill's concept of *Scyphiphora hydropylacea* and his interpretation of the type of *P. philippensis* as its synonym. Therefore, a specimen of the gathering is here designated as the neotype of *P. philippensis* and the second-step neotype of *Ixora manila*.

The type of *Scyphiphora hydropylacea*

With the application of *Psychotria philippensis* fixed, some further notes on *Scyphiphora* and *Scyphiphora hydropylacea* seem useful. As to the type of genus and species, the names were published by the German botanist Carl Friedrich von Gaertner (1772–1850, original German orthography Karl Friedrich von Gärtner) in a "Supplementum" (Gaertner 1806) to his father Joseph Gaertner's (1732–1791, original German orthography Joseph Gärtner) pioneering work on fruit and seed morphology "De fructibus et seminibus plantarum" (Gaertner 1788, 1790–1792). In writing his "Supplement", C. F. Gaertner made extensive use of his father's fruit and seed collection, which was largely based on specimens received from contemporary botanists. One of the most important sources J. Gaertner consulted was Banks's herbarium in London in 1778, and large parts of his 'Carpologia' were based on material that he received on loan or as duplicates through Banks' generosity (Deleuze 1805: 23–24; Stafleu 1969). Following in his father's footsteps, C. F. Gaertner also travelled to London in 1802 with the same aims (Stafleu 1969).

J. Gaertner's collection of fruits and seeds is kept in the herbarium of the University of Tübingen (TUB), as is the herbarium of his son, who added to his father's carpological collection and kept his own herbarium (Stafleu 1969). Yet, there is no extant original material of *Scyphiphora hydropylacea* in the Gaertner herbarium at TUB (Uta Grünert, personal comment). However, the protologue ("*Hydropylax*. Collect. Banksian.") indeed gives reference to traveler, naturalist and patron of science, Sir Joseph Banks (1743–1820), whose extensive private herbarium later became the foundation of the herbarium at the Natural History Museum, London (BM). There are a number of specimens and drawings of *S. hydropylacea* at BM associated with Banks, his herbarium and endeavors.

Two specimens, both mounted together on one sheet, are curated there as types of the name. The sheet is annotated in pencil as type of *Scyphiphora hydropylacea* with the place of publication of the name. The two specimens are labelled '1' and '2' in black ink on the mounting tape at the base of the shoots. The numbers correspond to meagre annotations of locality and collector on the verso of the sheet in the upper left corner, written in black ink, as was common practice in many herbaria at that time. These annotations are here-interpreted as being in the hand of Samuel Törner, who was employed as amanuensis in the Banks herbarium from 1792 to 1797 (Marshall 1978).

Specimen '1', BM 000945301, mounted on the upper left side of the sheet and annotated on the verso '1. Java prope Angerpoint. J. B.', is a small fragment of a fruiting branch with a single leaf. 'J. B.' refers to Joseph Banks and links the specimen to James Cook's first voyage aboard HMS Endeavour from 1768 to 1771, which is confirmed

by a printed label of a later date reading ‘Java 1770–71 Banks & Solander’. The specimen was collected at ‘Angerpoint’, here identified as the present-day coastal town of Anjer or Anyer on Java, a natural harbor and important victualling station during the passage of the Sunda Strait. The diaries and travelogues of Cook and Sydney Parkinson (1745–1771), Banks’ illustrator (Hawkesworth et al. 1773: 705; Parkinson 1773: 171; Cook 1893: 349), reported that a boat was sent ashore at Anger Point on 2 October 1770, to gather supplies, and the specimen was most likely collected then. However, neither Banks nor botanist Daniel Carlsson Solander (1733–1782) went ashore that day, as can be seen from Banks’s travelogue published by Hooker (1896: 363). For that reason, the gathering must have been made by one of the sailors gathering supplies, which probably explains the scrappy condition of the specimen.

Specimen ‘2’, BM 000945302, consists of four flowering branches and is annotated ‘2. Paolo Candor. Dav. Nelson’. It was collected by David Nelson (1740–1789), who participated in Cook’s third voyage aboard HMS Resolution (1776–1780) on behalf of Banks. The modern transcription of ‘Paolo Candor’ is Pulo Condor, now Côn Sơn Island, Vietnam. The gathering can be dated to 21–28 January 1780, based on King’s (1784: 450–464) account of the Resolution’s visit to the island.

Banks and his collaborators had already collected *Scyphiphora hydrophylacea* in flower and fruit in Australia, which the Endeavour expedition visited before returning home via the Dutch East Indies and the Cape of Good Hope (Banks et al. 1901: 46). Based on these gatherings, illustrations were produced under the unpublished name ‘Ixoroïdes littoralis’, and the corresponding artwork is held in the “Cook First Voyage Artwork Collection” in the library of the Natural History Museum in London. These materials include a first pencil sketch with color notes by Parkinson, made in 1770 somewhere at the mouth of the Endeavour River (plate number A4/169A). After Parkinson died on the return from the voyage in 1771 (see Parkinson 1773), the watercolors were completed by James Miller (plate number A4/169B, A4/169 2) and engraved by Charles White (plate number A4/169C, also water colored A4/169 5), both under the patronage of Banks. The illustration remained unpublished for over a century until a posthumous publication on Banks’s Australian plants from the expedition, edited by James Britten (Banks et al. 1901: 46, tab. 143). Corresponding specimens that could be located are BRI-AQ0450760, P00836560 and W0131767, all received from BM, and the former two are curated as types of *S. hydrophylacea*.

Another notable holding of *Scyphiphora hydrophylacea* material at BM is a long-unpublished watercolor by Ferdinand Bauer, made during the 1801–1803 circumnavigation of Australia on HMS Investigator under Captain Matthew Flinders. The watercolor shows a complete specimen with analysis of flowers and fruits, and was based on gatherings from the Northern Territory, also in the library of the Natural History Museum in London (Botany Library no. 70, Admiralty Library no. 122; see Mabberley and Moore 1999: 122, plate 70).

The materials of the Investigator expedition (1801–1803) were definitely not available at the Banksian herbarium during C. F. Gaertner’s visit in 1802. It is also unlikely that the Australian materials of the Endeavour expedition (1768–1771) were

seen by him, although they were surely accessioned in a timely manner after Banks' return. The specimens were gathered under the herbarium name 'Ixoroides littoralis', and there is no reference to that name in the protologue of *Scyphiphora hydropylacea*, where the material seen by Gaertner in the Banks herbarium is instead referred to the genus *Hydropylax* L. f. (Rubiaceae: Spermacoceae). The only species currently assigned to that genus, *Hydropylax maritima*, inhabits sea shores in India, Sri Lanka, Bangladesh and the western Thai part of the Malay peninsula. It has indehiscent fruits that superficially resemble *Scyphiphora* (e.g. Groeninckx et al. 2009; Puff 1986; Puff et al. 2021), which explains the use of the generic name for the undescribed material in the Banksian Herbarium, and also lends its name to the species epithet. Hence, the two specimens curated as types of *Scyphiphora* at BM remain to be considered as original material.

C. F. Gaertner described and illustrated the fruits of *Scyphiphora hydropylacea*, but made no mention of the flowers (Gaertner 1806: "Cor. ... Stam. ...") and the vegetative parts as for many other species that he described. Therefore it seems more likely that C. F. Gaertner either received isolated fruits on loan and did not study one or both of the complete specimens, or that the material had already been studied or received on loan by J. Gaertner during his visit in 1778, two years before the collection of Nelson's specimen, and that C. F. Gaertner built upon sketches, manuscripts or other materials inherited from his father. For these reasons, the flowering specimen gathered by Nelson (BM000945302) is not considered original material here, and the single fruiting specimen, BM000945301, is here designated as lectotype of the name *S. hydropylacea*.

A few years after Gaertner's (1806) publication, the plants were again described as a monotypic genus, *Epithinia*, by Jack, based on one of his gatherings from Singapore (Jack 1820: 12–13). *Epithinia malayana* was first synonymized with *Scyphiphora hydropylacea* by Korthals (1851: 203–204), and from Miquel (1857: 238–239) and especially Gray (1859: 307), onwards the names were consistently considered synonyms. The combination *S. malayana* (Jack) Bedd. was ascribed to Beddome and considered a valid name in various publications and databases. Although the name indeed first appears in the caption accompanying the respective figure analysis in his rare *Foresters Manual* (Beddome 1874: tab. 29, fig. 5), it is not accepted in the corresponding text (Beddome 1874: cxxxiv–3, using a combination of Roman and Arabic pagination). There, Beddome explains that the name used in the figure should be changed to *S. hydropylacea* ("Under the name of Scyh. malayana, which should be altered as above."). Apparently, the plates were engraved with the name before the text was finished, and Beddome changed his mind on the identity of the material during the completion of the text, as with few other species in the text. *S. malayana* is therefore not accepted by Beddome and is not valid according to Art. 36.1 (ICN, Turland et al. 2018). Wong et al. (2019: 283) designated the only currently known duplicate of the respective gathering *W. Jack s.n.* at L as lectotype.

Finally, the plants were again described as *Hydnophytum costatum* Drake (Drake del Castillo 1895) and based on *B. Balansa* 685 gathered in Vietnam. Again, the single known specimen was designated as lectotype by Wong et al. (2019: 283).

Bibliography of *Scyphiphora*

Selected and more or less useful historic and contemporary information and illustrations on *Scyphiphora hydrophylacea* can be found in chronological order in the following publications, some of them under synonyms added in parentheses:

Gaertner (1806: 91–92, tab. 196, fig. 2), Jack (1820: 12–13, as *Epithinia malayana*), Blume (1826–1827: 955), Chamisso and Schlechtendal (1829a: 21–22, as *Psychotria philippensis*), de Candolle (1830: 477–478, as *E. malayana*, 505–506, as *P. philippensis*, 577), Richard (1830: 79, tab. 4, fig. 1), Wight and Arnott (1834: 423–424, as *E. malayana*), Blanco (1837: 60–61, as *Ixora manila*), Endlicher (1838: 525–526, 545, on the latter page as *E. malayana*), Korthals (1851: 203–204), Griffith (1854a, b: 269–271, tab. 478, as *E. malayana*; 1854b: tab. 644A, is the same figure in different composition but named *Lumnitzera pentandra*, the corresponding text accompanying the figure – 1854a: 684 – apparently describes the actual *Lumnitzera*), Hasskarl (1855: 16–17), Miquel (1857: 238–239), Gray (1859: 307), Bentham and Mueller (1867: 417–418), Beddome (1874: 134–3, tab. 29, fig. 5), Kurz (1877: 4), Hooker (1880: 125), Naves and Fernández-Villar (1880: 109, tab. 277), Vidal (1883a, b: 29, tab. 57, fig. G, 1886: 154), Trimen (1894: 337), Schumann (1897: 80, fig. 29 B, C), Banks et al. (1901: 46, tab. 143), Koorders and Valeton (1902: 124–127), King and Gamble (1904: 227–228), Elmer (1906: 32), Koorders (1912: 258), Koorders and Valeton (1915: fig. 563), Merrill (1918: 364, 1923b: 533), Pitard (1922–1924: 280–282, tab. 23, figs 5–8), Ridley (1923: 88–89), Watson (1928: 84–87, tab. 43), White (1929), Valeton (1930: 303), Corner (1940: 559), Henderson (1950: 217–218, fig. 196), Bakhuizen van den Brink (1955: 101–102, 1975: 34–35), Backer and Bakhuizen van den Brink (1965: 316), Wong (1988: 197), Wong (1989: 408), Keng (1990: 161), Hô (1993: 206, fig. 7607), Puff and Rohrhofer (1993, richly illustrated), Turner (1995: 446), Ridsdale (1998: 235), Mabberley and Moore (1999: 122, pl. 70), Banerjee et al. (2002: 262), Puff et al. (2005: 82, pl. 3.1.19), Tao et al. (2011: 323) and Wong et al. (2019: 282–285, fig. 71).

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References

Alejandro GJD (2007) The current status of the Philippine Rubiaceae. *Philippine Journal of Systematic Biology* 1: 47–60. <https://doi.org/10.3860/pjsb.v1i1.908>

Alejandro GJD, Liede S (2003) The Philippine Rubiaceae genera: Updated synopsis in INTKEY databases of the DELTA System. *Blumea* 48(2): 261–277. <https://doi.org/10.3767/000651903X674964>

Alejandro GJD, Meve U, Liede-Schumann S (2016) A taxonomic revision of Philippine *Mussaenda* (Rubiaceae, Mussaendeae). *Annals of the Missouri Botanical Garden* 101(3): 457–524. <https://doi.org/10.3417/2010089>

Alejandro GJD, Meve U, Mouly A, Thiv M, Liede-Schumann S (2011) Molecular phylogeny and taxonomic revision of the Philippine endemic *Villaria* Rolfe (Rubiaceae). *Plant Systematics and Evolution* 296(1): 1–20. <https://doi.org/10.1007/s00606-011-0472-9>

Alejandro GJD, Meve U, Uy M, Mouly A, Thiv M, Liede-Schumann S (2010) Molecular support of the classification of *Greeniopsis* Merr. in Aleisanthieae (Rubiaceae), with a revision of the genus. *Taxon* 59(5): 1547–1564. <https://doi.org/10.1002/tax.595018>

Almazol AE, Cervancia CR (2013) Floral biology and pollination of three mangrove species (*Aegiceras floridum* Roem. & Schults., *Scyphiphora hydrophyllacea* Gaertn. f., and *Xylocarpus granatum* Koen.) in Pagbilao Mangrove forest, Quezon Province, Philippines. *Journal of Nature Studies* 12: 39–47.

Backer CA, Bakhuizen van den Brink RC (1965) Flora of Java (Spermatophytes only) (Vol. II). Angiospermae, Families 111–160. N.V. P. Noordhoff, Groningen.

Bakhuizen van den Brink RC (1955) Beknopte Flora van Java (Nooduitgave). Aflevering XV. Familie CLXXIV. Rubiaceae. Rijksherbarium, Leiden.

Bakhuizen van den Brink RC (1975) A synoptical key to the genera of the Rubiaceae of Thailand. *Thai Forest Bulletin* 9: 15–55.

Banerjee LK, Rao TA, Sastry ARK, Ghosh D (2002) Diversity of coastal plant communities in India. Kolkata: ENVIS & EMCBTAP, Botanical Survey of India, Ministry of Environment & Forests.

Banks J, Britten J, Solander D (1901) Illustrations of Australian Plants Collected in 1770 During Captain Cook's Voyage Round the World in H.M.S. Endeavour in 1768–71. By the Right Hon. Sir Joseph Banks, Bart., K.B., P.R.S., and Dr. Daniel Solander, F.R.S. With Determinations by James Britten, F.L.S. Australian Plants.—Part II. Printed by Order of the Trustees of the British Museum, London. <https://doi.org/10.5962/bhl.title.9539>

Batuyong MAR, Calaramo MA, Alejandro GJD (2021) Rediscovery and amended description of *Psychotria palimlimensis* (Rubiaceae): A rare species found only in Ilocos Norte, Philippines. *Nordic Journal of Botany* 39(7): e03253. <https://doi.org/10.1111/njb.03253>

Baumgartner J (1975) Manila – Maynilad or Maynila? *Philippine Quarterly of Culture and Society* 3(1): 52–54. <https://www.jstor.org/stable/29791188>

Beddome RH (1874) The forester's manual of botany for southern India. With plates I to XXIX. Containing analysis of genera, and outlines of botany. With index of terms and glossary by Col. Beddome, conservator of forests. *Flora Sylvatica for Southern India*. Printed by Gantz Brothers, Madras. <https://archive.org/details/dli.csl.8822>

Bentham G, Mueller F (1867) Flora Australiensis: A Description of the Plants of the Australian Territory (Vol. III). Myrtaceae to Compositae. Lovell Reeve & Co., London. <https://www.biodiversitylibrary.org/item/41807>

Berger A (2018) Rediscovery of Chamisso's type specimens of Hawaiian *Psychotria* (Rubiaceae, Psychotrieae) in the herbarium of the Natural History Museum, Vienna. *PhytoKeys* 114: 27–42. <https://doi.org/10.3897/phytokeys.114.29426>

Biag RD, Alejandro GJD (2020) Rediscovery of *Psychotria* species, subspecies, and varieties collected in the 1990s and new records of *Antirhea benguetensis* (Elmer) Valeton and *Ixora longifolia* Smith (Rubiaceae) in Northern Sierra Madre Natural Park, Luzon, Philipp. *Biodiversitas* 21(10): 4524–4535. <https://doi.org/10.13057/biodiv/d211059>

Biag RD, Alejandro GJD (2022) Range extension and emended description of the threatened *Psychotria catanduanensis* (Rubiaceae) in the coastal area in Palanan, Isabela, Luzon, Philippines. *Nordic Journal of Botany* 2022(4): e03422. <https://doi.org/10.1111/njb.03422>

Blanco M (1837) Flora de Filipinas. Segun el Sistema Sexual de Linneo. En la Imprenta de Sto. Tomas por D. Candido Lopez, Manila. <https://bibdigital.rjb.csic.es/idurl/1/9493>

Blanco M (1845) Flora de Filipinas, Segun el Sistema Sexual de Linneo. Segunda Impresion, Corregida y Aumentada. Imprenta de D. Miguel Sanchez, Manila. <https://books.google.at/books?hl=de&lr=&id=Zzk-AQAAMAAJ>

Blanco M (1877) Flora de Filipinas por el P. Fr. Manuel Blanco Agustino Calzado Adicionada con el Manuscrito Inédito del P. Fr. Ignacio Mercado las Obras de P. Fr. Antonio Llanos y de un Apéndice con Todas las Nuevas Investigaciones Botanicas Referentes al Archipiélago Filipino. Gran Edicion hecha a expensas de la Provincia de agustinos calzados de Filipinas bajo la dirección científica del P. Fr. Andrés Naves (Vol. 1). Establecimiento Tipografico de Plana y C.a., Manila. <https://www.biodiversitylibrary.org/item/277741>

Blume CL (1826–1827) Bijdragen tot de Flora van Nederlandsch Indië. 16de Stuk. Lands Drukkerij, Batavia. <https://doi.org/10.5962/bhl.title.395>

Bräuchler C, Schuster TM, Vitek E, Rainer H (2021) The Department of Botany at the Natural History Museum Vienna (Herbarium W)—history, status, and a best practice guideline for usage and requests. *Annalen des Naturhistorischen Museums in Wien. Serie B, für Botanik und Zoologie* 123: 297–322. http://verlag.nhm-wien.ac.at/pdfs/123B_297322_Braeuchler.pdf

Braun U, Wittig A-K (2003) Typusmaterial des Herbariums der Martin-Luther-Universität Halle-Wittenberg (HAL) Teil 4: Taxa beschrieben von D.F.L. von Schlechtendal. *Schlechtendalia* (Halle) 10: 15–65. <http://public.bibliothek.uni-halle.de/index.php/schlechtendalia/article/view/548>

Brooks TM, Mittermeier RA, da Fonseca GAB, Gerlach J, Hoffmann M, Lamoreux JF, Mittermeier CG, Pilgrim JD, Rodrigues ASL (2006) Global biodiversity conservation priorities. *Science* 313(5783): 58–61. <https://doi.org/10.1126/science.1127609>

Bzdziach K [Ed.] (2004) Mit den Augen des Fremden. Adelbert von Chamisso – Dichter, Naturwissenschaftler, Weltreisender. Gesellschaft für interregionalen Kulturaustausch e.V., Berlin.

Chamisso LKA (1818) Voyage de Kotzebue. Lettre écrite à M. le comte de Romanzoff, par M. de Chamisso, naturaliste français, qui a fait le voyage autour du monde, avec M. de Kotzebue, sur le bric le Rurick. *Journal des Voyages, Découvertes et Navigations Modernes* 1818(1): 201–208. <http://mdz-nbn-resolving.de/urn:nbn:de:bvb:12-bsb10465475-7>

Chamisso LKA (1826) De plantis in expeditione speculatoria Romanzoffiana observatis rationem dicunt. Praefatur. Linnaea 1(1): 1–11. <https://biodiversitylibrary.org/page/93273>

Chamisso LKA (1830) De plantis in expeditione speculatoria Romanzoffiana observatis dissere-re pergunt. Rutaceae. Linnaea 5(1): 43–59. <https://biodiversitylibrary.org/page/35307165>

Chamisso LKA (1836a) Reise um die Welt mit der Romanzoffischen Entdeckungs-Expedition in den Jahren 1815–1818 auf der Brigg Rurik, Cpt. Otto von Kotzebue. Erster Theil, Tagebuch. Adelbert von Chamisso's Werke. Erster Band. Weidmann'sche Buchhandlung, Leipzig. <http://resolver.sub.uni-goettingen.de/purl?PPN345209109>

Chamisso LKA (1836b) Reise um die Welt mit der Romanzoffischen Entdeckungs-Expedi-tion in den Jahren 1815–1818 auf der Brigg Rurik, Cpt. Otto von Kotzebue. Zweiter Theil, Anhang. Bemerkungen und Ansichten. Adelbert von Chamisso's Werke. Zweiter Band. Weidmann'sche Buchhandlung, Leipzig. <http://resolver.sub.uni-goettingen.de/purl?PPN345209168>

Chamisso LKA, Schlechtendal DFL (1826b) De plantis in expeditione speculatoria Romanzof-fiana observatis disserere pergunt. Ericaceae–Fumariaceae. Linnaea 1(4): 511–570. <https://biodiversitylibrary.org/page/37174969>

Chamisso LKA, Schlechtendal DFL (1827) De plantis in expeditione speculatoria Romanzoff-iana observatis disserere pergunt. Rosaceae. Linnaea 2(1): 1–37. <https://biodiversitylibrary.org/page/34851850>

Chamisso LKA, Schlechtendal DFL (1829a) De plantis in expeditione speculatoria Romanzof-fiana observatis disserere pergunt. Rubiaceae. Machaonia.–Tribus IV. Psychotriaceae. Lin-naea 4(1): 1–36. <https://biodiversitylibrary.org/page/95330>

Chamisso LKA, Schlechtendal DFL (1829b) De plantis in expeditione speculatoria Roman-zoffiana observatis disserere pergunt. Rubiaceae. Quae supersunt. Linnaea 4(2): 129–202. <https://biodiversitylibrary.org/page/95502>

Chamisso LKA, von Schlechtendal DFL (1826a) De plantis in expeditione speculatoria Romanzoffiana observatis disserere pergunt. Plantaginaceae–Primulaceae. Linnaea 1(2): 165–226. <https://biodiversitylibrary.org/page/37174623>

Chavez JG, Meve U, Liede-Schumann S (2020) Taxonomic novelties and changes in Philippine *Timonius* (Rubiaceae, Guettardeae). Nordic Journal of Botany 38(7): e02730. <https://doi.org/10.1111/njb.02730>

Choris L (1822) Voyage pittoresque autour du monde, avec des portraits de sauvages d'Amerique, d'Asie, d'Afrique, et des iles du Grand Ocean. De l'Imprimerie de Firmin Didot, Paris. <https://doi.org/10.5962/bhl.title.119397>

Cook J (1893) Captain Cook's journal during the first voyage round the world made in H.M. Bark "Endeavour" 1768–71. A literal transcription of the original MSS. With notes and introduction edited by captain W. J. L. Wharton, R.N., F.R.S., Hydrographer of the admiralty. Illustrated by maps and facsimiles. Elliot Stock, London. <https://books.google.at/books?id=VM45AQAAQAAJ>

Corner EJH (1940) Wayside trees of Malaya (Vol. I). Government Printing Office, Singapore.

de Candolle AP (1830) Ordo XCVIII. Rubiaceae. Prodromus systematis naturalis vegeta-bilis. Pars quarta. Treuttel et Würtz, Paris, 341–622. <https://www.biodiversitylibrary.org/item/7153#page/346>

Deleuze JPF (1805) Über das Leben und die Werke Gärtners und Hedwig's: aus den französischen Annalen des Museums der Naturgeschichte übersetzt. F. W. Metzler, Stuttgart. <https://books.google.at/books?id=Qvo5AAAAcAAJ>

Drake del Castillo E (1895) Contribution a la Flore du Tonkin. Enumeration des Rubiacees trouvees au Tonkin par M. Balansa en 1885–89 (Suite et fin.). Journal de Botanique 9: 234–241. <https://www.biodiversitylibrary.org/page/8855294#page/244>

Elmer ADE (1906) Philippine Rubiaceae. Leaflets of Philippine Botany 1(1): 1–41. <https://www.biodiversitylibrary.org/item/6760>

Endlicher SL (1838) Genera Plantarum Secundum Ordines Naturales Disposita. Apud Fr. Beck Universitatis Bibliopolam, Vindobonae. <https://doi.org/10.5962/bhl.title.728>

Gaertner CF (1806) Supplementum carpologiae seu continuati operis Josephi Gaertner de fructibus et seminibus plantarum. Voluminis tertii, centuria prima. Sumtibus Carol. Frid. Enoch Richter, Bibliopolae Lipsiensis, 57–128. <https://doi.org/10.5962/bhl.title.59684>

Gaertner J (1788) De fructibus et seminibus plantarum. Accedunt seminum centuriae quinque priores cum tabulis aeneis LXXIX. Typis Academiae Carolinae, Stutgardiae. <https://doi.org/10.5962/bhl.title.53838>

Gaertner J (1790–1792) De fructibus et seminibus plantarum volumen alterum. Continens seminum centuriae quinque posteriores cum tabulis aeneis CI. Typis Guilielmi Henrici Schrammii, Tubingae. <https://doi.org/10.5962/bhl.title.53838>

Govaerts R, Ruhsam M, Andersson L, Robbrecht E, Bridson D, Davis A, Schanzer I, Sonk B (2022) World Checklist of Rubiaceae. Facilitated by the Royal Botanic Gardens, Kew. <http://apps.kew.org/wcsp> [accessed October 2022]

Gray A (1859) Notes upon some Rubiaceae, collected in the South Sea Exploring Expedition under Captain Wilkes. Proceedings of the American Academy of Arts and Sciences 4: 306–318. <https://www.biodiversitylibrary.org/item/22142#page/314>

Griffith W (1854a) Posthumous papers bequeathed to the honorable the East India company, and printed by order of the government of Bengal. Notulae ad plantas asiaticas. Part IV. Dicotyledonous plants. Arranged by John M'Clelland. Printed by Charles A. Serrao, Calcutta. <https://www.biodiversitylibrary.org/item/42870>

Griffith W (1854b) Posthumous papers, bequeathed to the honorable the East India company, and printed by order of the government of Bengal. Icones plantarum asiaticarum. Part IV. Dicotyledonous plants. Arranged by John M'Clelland. Printed by A. B. Coshan, Calcutta. <https://www.biodiversitylibrary.org/item/132442>

Groeninckx I, Dessein S, Ochoterena H, Persson C, Motley TJ, Kårehed J, Bremer B, Huysmans S, Smets E (2009) Phylogeny of the herbaceous tribe Spermacoceae (Rubiaceae) based on plastid DNA Data. Annals of the Missouri Botanical Garden 96(1): 109–132. <https://doi.org/10.3417/2006201>

Hasskarl JK (1855) Retzia Sive Observationes Botanicae, Quas in Primis in Horto Botanico Bogoriensi Mensibus Februario ad Julium 1855. Pugillus primus. Typis Lange & Co., Bataviae. <https://books.google.at/books?id=YgT1pw7f2-UC>

Hawkesworth J, Byron J, Wallis S, Carteret P, Cook J, Banks J (1773) An Account of the Voyages Undertaken by Order of his Present Majesty for Making Discoveries in the Southern Hemisphere, and Successively Performed by Commodore Byron, Captain Wallis, Captain

Carteret and Captain Cook, in the Dolphin, the Swallow and the Endeavour: Drawn up from the Journals which were Kept by the Several Commanders, and from the Papers of Joseph Banks, Esq.; by John Hawkesworth, LL.D. In three volumes. Illustrated with cuts, and a great variety of charts and maps relative to countries now first discovered, or hitherto but imperfectly known (Vol. III). Printed for W. Strahan; and T. Cadell in the Strand, London. <https://www.biodiversitylibrary.org/item/303535>

Henderson MR (1950) Malayan wild flowers. Dicotyledons. Part II. Malayan Nature Journal 6(1): 182–399.

Hiepko P (1987) The collections of the Botanical Museum Berlin-Dahlem (B) and their history. *Englera* 7: 219–252. <https://www.jstor.org/stable/3776724>

Hiepko P (2004) Der Naturwissenschaftler Adelbert von Chamisso und das Herbarium am Botanischen Garten in Schöneberg. Mit den Augen des Fremden. Adelbert von Chamisso – Dichter, Naturwissenschaftler, Weltreisender. Gesellschaft für interregionalen Kulturaustausch e.V., Berlin, 107–116.

Hô PH (1993) Cây cỏ Việt Nam. An illustrated Flora of Vietnam. Tome III, Fascicle 1. Mekong-Print, Montreal.

Hooker JD (1880) The Flora of British India (Vol. III). Caprifoliaceae to Apocynaceae. Part VIII. L. Reeve & Co, London. <https://www.biodiversitylibrary.org/item/13816>

Hooker JD (1896) Journal of the Right Hon. Sir Joseph Banks during Captain Cook's first voyage in H.M.S. Endeavour in 1768–71 to Terra del Fuego, Otahite, New Zealand, Australia, the Dutch East Indies, etc. Macmillan and Co., Ltd., London. <https://doi.org/10.5962/bhl.title.56795>

Imchanitzkaja NN (2004) Die Sammlungen von Chamisso und Eschscholtz im Herbarium des Botanischen Institutes „W.L. Komarow“ der Russischen Akademie der Wissenschaften zu Sankt Petersburg. In: Mit den Augen des Fremden. Adelbert von Chamisso – Dichter, Naturwissenschaftler, Weltreisender. Gesellschaft für interregionalen Kulturaustausch e.V., Berlin, 123–132.

Jack W (1820) Descriptions of Malayan plants. No. 2. Malayan Misc. 1(5): 1–49. <https://books.google.at/books?id=vxYIAAAAQAAJ>

Kainulainen K, Razafimandimbison SG, Bremer B (2013) Phylogenetic relationships and new tribal delimitations in subfamily Ixoroideae (Rubiaceae). *Botanical Journal of the Linnean Society* 173(3): 387–406. <https://doi.org/10.1111/boj.12038>

Keng H (1990) The Concise Flora of Singapore. Gymnosperms and Dicotyledons. Singapore University Press, Singapore.

King G, Gamble JS (1904) Materials for a flora of the Malayan Peninsula. (no. 14). *Journal of the Asiatic Society of Bengal*. Part 2. Natural History 72(2): 111–229. <https://www.biodiversitylibrary.org/item/110113#page/137>

King J (1784) A voyage to the Pacific ocean. Undertaken, by the command of His Majesty, for making discoveries in the Northern hemisphere, to determine the position and extent of the west side of North America; its distance from Asia; and the practicability of a northern passage to Europe. Performed under the direction of Captains Cook, Clerke, and Gore, in his Majesty's Ships the Resolution and Discovery. In the years 1776, 1777, 1778, 1779, and 1780. In Three Volumes. Vol. I and II written by James Cook, F.R.S. Vol. III by Cap-

tain James King, LL.D. and F.R.S. Printed by W. and A. Strahan, London. <https://doi.org/10.5962/bhl.title.6762>

Koopowitz H, Sohmer S, Thornhill A, Perez G (1998) Deforestation and plant species extinctions in the Philippines: *Psychotria* as an example. In: Peng C, Lowry P (Eds) Rare, Threatened and Endangered Floras of Asia and the Pacific Rim. Academia Sinica Monograph Series No. 16, Taipei, 111–121.

Koorders SF, Valeton T (1902) Bijdrage no. 8 tot de Kennis der Boomsoorten op Java. Additamenta ad cognitionem Florae arboreae Javanicae auctoris S. H. Koorders et Th. Valeton Pars VIII. G. Kolff & Co., Batavia. <https://www.biodiversitylibrary.org/item/196515>

Koorders SH (1912) Exkursionsflora von Java umfassend die Blütenpflanzen mit besonderer Berücksichtigung der im Hochgebirge wildwachsenden Arten im Auftrage des niederländischen Kolonialministeriums, bearbeitet von Dr. S. H. Koorders. Dritter Band: Dikotyledonen (Metachlamydeae). Verlag von Gustav Fischer, Jena.

Koorders SH, Valeton T (1915) Atlas der Baumarten von Java im Anschluss an die “Bijdragen tot de Kennis der Boomsoorten van Java” zusammengestellt von Dr. S. H. Koorders und Dr. Th. Valeton. Mit Unterstützung der Niederländisch-Indischen Regierung herausgegeben von Dr. S. H. Koorders. Dritter Band. Figur 401–600. <https://doi.org/10.5962/bhl.title.101654>

Korthals PW (1851) Overzigt der Rubiaceën van de Nederlandsch-Oostindische Kolonien. Nederlandsch Kruidkundige Archief 2(2): 145–269. <https://www.biodiversitylibrary.org/item/107156#page/445>

Kotzebue O (1821) Entdeckungsreise in die Südsee und nach der Beringstraße zur Erforschung der nordöstlichen Durchfahrt. Unternommen in den Jahren 1815, 1816, 1817 und 1818 auf Kosten Sr. Erlaucht des Herrn Reichs-Kanzlers Grafen Rumanzoff auf dem Schiffe Rurick unter dem Befehl des Lieutenants der Russisch-Kaiserlichen Marine Otto von Kotzebue. Dritter Band. Enthält die Bemerkungen und Ansichten von dem Naturforscher der Expedition, Albert v. Chamisso, nebst Beiträgen von andern Gelehrten. Gebrüder Hoffmann, Weimar. <https://doi.org/10.5962/bhl.title.48463>

Kuntze CEO (1891) Revisio Generum Plantarum Vascularium Omnium Atque Cellularium Multarum Secundum Leges Nomendaturae Internationales cum Enumeratione Plantarum Exoticarum in Itinere Mundi Collectarum. Pars 2. A. Felix, Leipzig. <https://doi.org/10.5962/bhl.title.327>

Kurz S (1877) Forest Flora of British Burma (Vol. II). Caprifoliaceae to Filices. Office of the superintendent of government printing, Calcutta. <https://doi.org/10.5962/bhl.title.52413>

Lachenaud O (2019) Révision du genre *Psychotria* (Rubiaceae) en Afrique Occidentale et Centrale. Opera Botanica Belgica 17: 1–909.

Maaß Y (2016) Leuchtkäfer & Orgelkoralle. Chamisso's Reise um die Welt mit der Romanzoffschen Entdeckungs-Expedition (1815–1818) im Wechselspiel von Naturkunde und Literatur. Epistemata Würzburger Wissenschaftliche Schriften, Reihe Literaturwissenschaft 852. Königshausen & Neumann, Würzburg. <https://nbn-resolving.org/urn:nbn:de:kobv:517-opus4-399894>

Mabberley DJ, Moore DT (1999) Catalogue of the holdings in The Natural History Museum (London) of the Australian botanical drawings of Ferdinand Bauer (1760–1826)

and cognate materials relating to the *Investigator* voyage of 1801–1805. Bulletin of the Natural History Museum Botany Series 29(2): 81–226. <https://www.biodiversitylibrary.org/page/41129993>

Marshall JB (1978) The handwriting of Joseph Banks, his scientific staff and amanuenses. Bulletin of the British Museum (Natural History). Botany 6(1): 1–85.

Merrill ED (1915) Studies on Philippine Rubiaceae, II. Philippine Journal of Science, Section C: Botany 10(2): 99–144. <https://www.biodiversitylibrary.org/page/709549#page/102>

Merrill ED (1918) Species Blancoanae: a critical revision of the Philippine species of plants described by Blanco and by Llanos. Department of Agriculture and Natural Resources. Bureau of Science Publication No. 12, Manila, 423 pp. <https://doi.org/10.5962/bhl.title.2116>

Merrill ED (1923–1925) An enumeration of Philippine flowering plants (Vol. 1). Bureau of Printing, Manila. <https://doi.org/10.5962/bhl.title.49412>

Merrill ED (1923a) An enumeration of Philippine flowering plants (Vol. 2). Bureau of Printing, Manila. <https://doi.org/10.5962/bhl.title.49412>

Merrill ED (1923b) An enumeration of Philippine flowering plants (Vol. 3). Bureau of Printing, Manila. <https://doi.org/10.5962/bhl.title.49412>

Merrill ED (1926) An enumeration of Philippine flowering plants (Vol. 4). Bureau of Printing, Manila.

Miquel FAW (1857) Flora van Nederlandsch Indië. Tweede Deel. Amsterdam: C. G. van der Post. Utrecht: C. Van der Post Jr. Leipzig: bij Fried. Fleischer. <https://doi.org/10.5962/bhl.title.93>

Mouly A, Razafimandimbison SG, Florence J, Jérémie J, Bremer B (2009) Paraphyly of *Ixora* and new tribal delimitation of Ixoreae (Rubiaceae): Inference from combined chloroplast (rps16, rbcL, and trnT-F) sequence data. Annals of the Missouri Botanical Garden 96(1): 146–160.

Myers N, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Kent J (2000) Biodiversity hotspots for conservation priorities. Nature 403(6772): 853–858. <https://doi.org/10.1038/35002501>

Naves A, Fernández-Villar C (1880) Novissima appendix ad floram Philippinarum R. P. Fr. Emanuël Blanco seu enumeratio contracta plantarum Philippinarum hucusque cognitarum cum synonymis PP. Blanco, Llanos, Mercado et aliorum auctorum. In: Blanco FM (Ed.) Flora de Filipinas ed. 3(4). Apud Plana et Socios, Typographos et Bibliopolas, Manila. <https://www.biodiversitylibrary.org/item/279871>

Nepokroeff M, Bremer B, Sytsma KJ (1999) Reorganization of the genus *Psychotria* and tribe Psychotrieae (Rubiaceae) inferred from ITS and rbcL sequence data. Systematic Botany 24(1): 5–27. <https://doi.org/10.2307/2419383>

Nicolson DH, Arculus D (2001) Candidates for neotypification of Blanco's names of Philippine plants: Specimens in the US National Herbarium. Taxon 50(3): 947–954. <https://doi.org/10.1002/j.1996-8175.2001.tb04001.x>

Obico JJA, Alejandro GJD (2012) Molecular phylogeny of the Philippine endemic genus *Antherostele* Bremek. (Rubiaceae) inferred from ITS data (nrDNA) and its conservation status. American Journal of Plant Sciences 10(3): 1399–1407. <https://doi.org/10.4236/ajps.2012.310169>

Ordas JAD, Pinarok NAA, Romeroso RB, Alejandro GJD, Banag-Moran CI (2019) A checklist of Rubiaceae species from Eastern Samar, Visayas, Philippines. Check List 15(2): 295–312. <https://doi.org/10.15560/15.2.295>

Parkinson S (1773) A Journal of a Voyage to the South Seas in his Majesty's Ship, the Endeavour. Faithfully Transcribed from the Papers of the Late Sydney Parkinson, Draughtsman to Joseph Banks, Esq. on His Late Expedition, with Dr. Solander, Round the World. Embellished with Views and Designs, Delineated by the Author, and Engraved by Capital Artists. Printed for Stanfield Parkinson, the editor, London. <https://wellcomecollection.org/works/avhtumqu>

Pelser PB, Barcelona JF, Nickrent DL [Eds] (2011 onwards) Co's Digital Flora of the Philippines. <https://www.philippineplants.org> [Accessed October 2022]

Pereira JT, Ridsdale CE (2012) A synopsis of *Rothmannia* (Rubiaceae) in the Philippines, with four new combinations and a new species. *Sandakania* 18: 15–32.

Pitard C-JM (1922–1924) Rubiacées. In: Lecomte PH (Ed.) Flore générale de l'Indochine. Tome troisième: Caprifoliacées à Apocynacées, 442 pp. <https://doi.org/10.5962/bhl.title.44886>

Posa MRC, Diesmos AC, Sodhi NS, Brooks TM (2008) Hope for threatened tropical biodiversity: Lessons from the Philippines. *Bioscience* 58(3): 231–240. <https://doi.org/10.1641/B580309>

Puff C (1986) *Phylohydrax* (Rubiaceae-Spermacoceae) – a new genus to accommodate the African and Madagascan “*Hydropylax*” species. *Plant Systematics and Evolution* 154(3–4): 343–366. <https://doi.org/10.1007/BF00990132>

Puff C, Chayamarit K, Chamchumroon V (2005) Rubiaceae of Thailand: A pictorial guide to indigenous and cultivated genera. Forest Herbarium, National Park, Wildlife and Plant Conservation Department, Bangkok.

Puff C, Chayamarit K, Chamchumroon V, Esser H-J (2021) Rubiaceae (Genera 1–45). Bangkok: The Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation. *Flora of Thailand* 15(1): 1–235.

Puff C, Rohrhofer U (1993) The character states and taxonomic position of the monotypic mangrove genus *Scyphiphora* (Rubiaceae). *Opera Botanica Belgica* 6: 143–172.

Razafimandimbison SG, Kainulainen K, Wong KM, Beaver K, Bremer B (2011) Molecular support for a basal grade of morphologically distinct, monotypic genera in the species-rich Vanguerieae alliance (Rubiaceae, Ixoroideae): Its systematic and conservation implications. *Taxon* 60(4): 941–952. <https://doi.org/10.1002/tax.604001>

Razafimandimbison SG, Taylor CM, Wikström N, Pailler T, Khodabandeh A, Bremer B (2014) Phylogeny and generic limits in the sister tribes Psychotrieae and Palicoureeae (Rubiaceae): Evolution of schizocarps in *Psychotria* and origins of bacterial leaf nodules of the Malagasy species. *American Journal of Botany* 101(7): 1102–1126. <https://doi.org/10.3732/ajb.1400076>

Richard A (1830) Mémoire sur la famille des Rubiacées, contenant les caractères des genres de cette famille et d'un grand nombre d'espèces nouvelles. Imprimerie de J. Tastu, Paris. <https://books.google.at/books?id=CtMaAAAAYAAJ>

Ridley HN (1923) The Flora of the Malay Peninsula (Vol. II.)—Gamopetalae. L. Reeve & Co., Ltd., London. <https://doi.org/10.5962/bhl.title.10921>

Ridsdale CE (1998) Rubiaceae. In: Dassanayake MD, Clayton WD (Eds) A Revised Handbook to the Flora of Ceylon (Vol. XII). A. A. Balkema, Rotterdam, 143–343.

Robbrecht E, Manen JF (2006) The major evolutionary lineages of the coffee family (Rubiaceae, Angiosperms). Combined analysis (nDNA and cpDNA) to infer the position of *Coptosapelta* and *Luculia*, and supertree construction based on rbcL, rps16, trnL-trnF and atpB-

rbcL data. A new classification in two subfamilies, Cinchonoideae and Rubioideae. *Systematics and Geography of Plants* 76(1): 85–145. <https://www.jstor.org/stable/20649700>

Ruprecht JF (1864) Das botanische Museum. *Bulletin de l'Académie Impériale des Sciences de Saint-Pétersbourg* 7(Suppl. 2): 1–10. <https://biodiversitylibrary.org/page/33683741>

Schlechtendal DFL (1839) Dem Andenken an Adelbert von Chamisso als Botaniker. *Linnaea* 13: 93–112. <https://biodiversitylibrary.org/page/35386360>

Schmid G (1942) Chamisso als Naturforscher. Eine Bibliographie von Dr. Günther Schmid, Professor in Halle. Köhler, Leipzig.

Schumann K (1897) Rubiaceae. In: Engler A, Prantl K (Eds) *Die Natürlichen Pflanzenfamilien* nebst ihren Gattungen und wichtigeren Arten, insbesondere den Nutzpflanzen, unter Mitwirkung zahlreicher hervorragender Fachgelehrten begründet von A. Engler und K. Prantl fortgesetzt von A. Engler, ord. Professor der Botanik und Direktor des botan. Gartens in Berlin. IV. Teil Abteilung 4 und 5. Verlag von Wilhelm Engelmann, Leipzig, 156 pp. <https://www.biodiversitylibrary.org/item/100167>

Sohmer SH (2001) Conservation lessons from studies in Philippine *Psychotria*. In: Wong KM, Lee SS, Saari G (Eds) *Species, landscapes and islands: Perspectives in tropical botany*. Malayan Nature Journal 55(1–2): 43–47.

Sohmer SH, Davis AP (2007) The genus *Psychotria* (Rubiaceae) in the Philippine Archipelago. *Sida. Botanical Miscellany* 27: 1–247.

Stafleu FA (1969) Joseph Gaertner and his carpologia. *Acta Botanica Neerlandica* 18(1): 216–223. <https://doi.org/10.1111/j.1438-8677.1969.tb00586.x>

Tao C, Xianrui L, Hua Z, Taylor CM, Ehrendorfer F, Lantz H, Funston M, Puff C (2011) Flora of China (Curcurbitaceae through Valerianaceae with Annonaceae and Berberidaceae). 19: 1–884. In: Wu CY, Raven PH, Hong DY (Eds) *Flora of China*. Science Press & Missouri Botanical Garden Press, Beijing & St. Louis.

Taylor CM (1996) Overview of the Psychotrieae (Rubiaceae) in the Neotropics. *Opera Botanica Belgica* 7: 261–270.

Taylor CM (2020) Overview of *Psychotria* in Madagascar (Rubiaceae, Psychotrieae), and of Bremekamp's foundational study of this group. *Candollea* 75(1): 51–70. <https://doi.org/10.15553/c2020v751a5>

Taylor CM, Razafimandimbison SG, Barrabé L, Jardim JG, Barbosa MRV (2017) *Eumachia* expanded, a pantropical genus distinct from *Psychotria* (Rubiaceae, Palicoureeae). *Candollea* 72(2): 289–318. <https://doi.org/10.15553/c2017v722a6>

Trimen H (1894) *A Hand-Book to the Flora of Ceylon Containing Descriptions of all the Species of Flowering Plants Indigenous to the Island, and Notes to their History and Distribution, and Uses. Part II. Connaraceae–Rubiaceae*. Dulau & Co., London. <https://doi.org/10.5962/bhl.title.10864>

Turland NJ, Wiersema JH, Barrie FR, Greuter W, Hawksworth DL, Herendeen PS, Knapp S, Kusber W-H, Li D-Z, Marhold K, May TW, McNeill J, Monro AM, Prado J, Price MJ, Smith GF [Eds] (2018) *International Code of Nomenclature for Algae, Fungi, and Plants (Shenzhen Code)* Adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. *Regnum Vegetabile* 159. Koeltz Botanical Books, Glashütten. <https://doi.org/10.12705/Code.2018>

Turner IM (1995) A Catalogue of the Vascular Plants of Malaya. Gardens' Bulletin (Singapore) 47(2): 347–501.

Urban I (1917) Geschichte des Königlichen Botanischen Museums zu Berlin-Dahlem (1815–1913) nebst Aufzählung seiner Sammlungen. Beihefte zum Botanischen Centralblatt. Sect. 1(34): 1–457.

Valeton T (1930) Die Rubiaceen von Mikronesien. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 63: 289–323.

Vidal S (1883a) Sinopsis de Familias y Generos de Plantas Leñosas de Filipinas, Introducción á la Flora Forestal del Archipiélago Filipino. Texto. Establecimiento Tipo-litográfico de Chofré y Ca, Manila. <https://bibdigital.rjb.csic.es/idurl/1/9653>

Vidal S (1883b) Sinopsis de Familias y Generos de Plantas Leñosas de Filipinas, Introducción á la Flora Forestal del Archipiélago Filipino. Atlas. Establecimiento Tipo-litográfico de Chofré y Ca, Manila. <https://bibdigital.rjb.csic.es/idurl/1/9654>

Vidal S (1886) Revision de Plantas Vasculares Filipinas. Establecimiento Tipo-Litográfico de M. Perez, Hijo, Manila. <https://doi.org/10.5962/bhl.title.14963>

Watson JG (1928) Mangrove Forests of the Malay Peninsula. Malayan Forest Records 6. Printed by Fraser & Neave, Singapore. <https://archive.org/details/mangroveforestso00wats>

Webb CO, Slik JWF, Triono T (2010) Biodiversity inventory and informatics in Southeast Asia. Biodiversity and Conservation 19(4): 955–972. <https://doi.org/10.1007/s10531-010-9817-x>

Werner K (1988) Zur Geschichte des Herbariums der Martin-Luther-Universität Halle-Wittenberg nebst Anmerkungen zu einigen Sammlungen. Hercynia 25(1): 11–26. <http://public.bibliothek.uni-halle.de/index.php/hercynia/article/view/1362>

White CT (1929) Ligneous plants collected in the territory of Papua (British New Guinea) in 1925–26 by L. J. Brass. Journal of the Arnold Arboretum 10(4): 197–274. <https://doi.org/10.5962/p.333876>

Wight R, Arnott GAW (1834) Prodromus florae peninsulae indiae orientalis: Containing abridged descriptions of the plants found in the peninsula of British India, arranged according to the natural system (Vol. I). Parbury, Allen & Co., London. <https://doi.org/10.5962/bhl.title.252>

Wikström N, Bremer B, Rydin C (2020) Conflicting phylogenetic signals in genomic data of the coffee family (Rubiaceae). Journal of Systematics and Evolution 58(4): 440–460. <https://doi.org/10.1111/jse.12566>

Wong KM (1988) The Arborescent Rubiaceae of Malaya: A Manual of Trees of Malayan Rubiaceae. Forest Research Institute Malaysia, Kuala Lumpur.

Wong KM (1989) Rubiaceae. In: Ng FSP (Ed.) Tree Flora of Malaya. A Manual for Foresters (Vol. 4). Forest Research Institute Malaysia, Kuala Lumpur.

Wong KM, Low YW (2011) A revision of Philippine *Gardenia* (Rubiaceae). Edinburgh Journal of Botany 68(1): 11–32. <https://doi.org/10.1017/S0960428610000272>

Wong KM, Turner IM, Wang RJ, Harwood R, Seah WW, Ng XY, Lim RCJ, Lua HK, Mahyuni R (2019) Rubiaceae. In: Middleton DJ, Leong-Škorničková J, Lindsay S (Eds) Flora of Singapore (Vol. 13). Gentianales, 358 pp. <https://doi.org/10.26492/fos13.2019-01>